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Soil Fertility Trials.

RESULTS OF THE 1947 SEASON.

By L. G. VALLANCE.

THE extreme shortage of labour which persisted throughout the 1947 season and which was particularly manifest during the harvesting period greatly curtailed the number of fertility trials completed during the year under review. In many cases experimental plots which had been set out during the previous year had to be abandoned when about to be harvested because it was not possible to procure the extra labour required. Fortunately the interest taken by a large number of growers in the farm fertility experimental work and their ready co-operation in the face of their own labour difficulties was responsible for the successful completion of a considerable number of trials. To these farmers the Bureau desires to express its grateful appreciation.

MINOR ELEMENT TRIALS.

This type of soil fertility experiment (some results of which were published last year) was continued and a number of trials were completed during the year. It was previously pointed out ("Quarterly Bulletin," April, 1947) that in addition to the better known plant foods, such as nitrogen, phosphoric acid and potash, there are other substances the presence of which are essential for plant growth. Because these are required in very small amounts only they are usually called "minor" elements.

Since many areas have been growing sugar cane continuously for a large number of years it was considered probable that some soils may have become deficient in one or other of these materials. Accordingly, therefore, in as many districts as possible, a series of trials were put out in which light applications of copper, zinc, manganese and boron compounds were applied to both plant and ratoon cane. Normal applications of fertilizer were given to the treated areas as well as the check plots. Although in a few cases the cane from the variously treated plots was weighed at harvest, it was generally considered sufficient to compare the effects of the treatments merely by regular observations of the growth of the cane, taking into account such factors as strike, germination, stooling, rate of growth, colour, &c. Table 1 shows the locations of the various trials.

TABLE 1.

Results of Minor Element Farm Trials.

(*a*) Location Showing no Response.	(*b*) Location Showing Response.
Meerawa, *via* Gordonvale (W. Irvine)	Bli Bli, Maroochy (E. Burne)
Highleigh, *via* Gordonvale (Stager & Sons) ..	
Coorumba, South Johnstone (W. J. Henderson)	
Silkwood, Mourilyan (W. L. Poustie)	
Home Hill (Milburn Bros.)	
Dick's Bank, Ayr (Phillips Bros.)	
Ivanhoe, Ayr (B. Tapiolas)	
Walkerston, Mackay (Ritchie Bros.)	
Homebush, Mackay (F. Stevens)	
Dow's Creek, Mackay (J. L. Wilkie)	
Clayton, Bundaberg (A. M. Burke)	
South Kalkie, Bundaberg (E. H. Newitt) ..	
Elliot, Bundaberg (N. Patrucco)	
Kepnock, Bundaberg (G. Torrisi)	

The results of these trials, which were widely distributed over the main sugar-producing soils, indicate that, in general, a deficiency of minor elements does not occur. It would appear that even after many years of cultivation to sugar cane the content of these soils as regards available copper, zinc, boron and manganese has not been exhausted.

The one exception occurred on a light-grey sandy soil at Bli Bli, in the Maroochy district. For a number of years cane growing on this and similar soils has been frequently affected by what is locally known as "droopy top," the symptoms of which are fully described elsewhere in this issue of the Quarterly Bulletin. This trouble has been known for some time, and although originally it was somewhat sporadic and patchy in occurrence, it is now showing sufficient signs of spreading to cause concern. Applications of copper and zinc have given evidence of overcoming the trouble, and the treated areas have begun to show a striking, beneficial effect due to the presence of these two substances. However, further information is required before a general recommendation is issued regarding the use of copper and zinc on these soils, and to this end another trial has already been set out. It is suggested that any grower in the Maroochy district who is troubled with "droopy top" in either plant or ratoon cane might get in touch with this office, or our local Adviser in Cane Culture, stationed at Nambour.

In addition to the abovementioned experiments, the results of which were purely observational, the first ratoon crop of two minor element trials on Mackay and Bundaberg Experiment Stations were harvested and weighed. As was the case with the figures for the plant crops (given in the Quarterly Bulletin, April, 1947) there was again no difference in the weight of cane from the variously treated plots. As a matter of interest, the yields of both plant and first ratoon crops are given in Table 2. The small differences which occur are due to other causes, such as soil variation, and have not been brought about by the different applications.

TABLE 2.

*Results of Minor Element Trials at Mackay and Bundaberg Experiment Stations. (Cane, tons per acre.)

Treatment.	Fert. only.	Fert. + Copper.	Fert. + Zinc.	Fert. + Boron.	Fert. + Manganese.
Mackay, Plant	27·5	26·7	26·0	26·2	27·3
First Ratoon ..	19·4	17·7	17·8	18·1	19·8
Total	46·9	44·4	43·8	44·3	47·1
Bundaberg, Plant ..	19·4	17·6	19·0	18·7	17·6
First Ratoon..	23·9	23·9	23·7	24·1	25·2
Total	43·3	41·5	42·7	42·8	42·8

* The statistical analyses of these two 5 x 5 Latin Square trials showed no significant difference due to treatment.

LIME TRIALS.

During the year a large number of lime trials were harvested. These were part of a comprehensive series consisting of approximately 100 trials set out on most of the more important sugar cane soils. Single plots were used on farm properties from Mossman to the Bundaberg district. In each case a check plot—that is, one which had received no lime—was used for comparison purposes and was immediately adjacent to the plot which had received an application of agricultural lime at the rate of 2 tons per acre. At the time of writing the series had not been completely harvested, and until all plots have been finalised it is not possible to give a complete report. However, in view of the fact that a considerable number of yield figures are available and also because a great deal of interest has been taken in the probable beneficial effect of lime on sugar cane soils, it has been thought worthwhile to compile these notes as a progress report. In the following tables are given a list of the various localities in which the trials were conducted. Table 3 (*a*) indicates the experiments which showed responses to lime and 3 (*b*) those in which no beneficial effect could be detected.

It will be seen that although the differences between the limed plots and the unlimed areas are relatively small when calculated in tons per acre, the number of cases in which lime exerted a beneficial effect is very much greater than those in which no results occurred. It is expected that the main effects of the lime application will be shown up in the ratoon crops, and for this reason it will be necessary to continue the experiments for some time before the total responses to lime can be ascertained. Up to the present, in general, the increase in yield per acre has not been sufficient to offset the cost of the lime application. However, it is felt that the very fact that there has been such a very general response to lime indicates that many areas may now be becoming deficient in this respect, and although the responses are not great, any factor which limits the production of cane should be regarded as a serious one and steps taken to overcome it before the deterioration becomes more marked.

TABLE 3.

Results of Lime Trials Harvested to Date.

(*a*) Trials showing response to lime.

Location.	Yield (tons Cane per Acre.)	
	Lime Plot.	No Lime.
Cucania (W. Kearns)	26·5	26.0
Fishery Falls (Harlow & Sons)	24·7	23·0
Mossman (A. & C. Caltabiano)	28·5	26·8
Mossman (C. Buchanan)	19 8	15·5
Mossman (Mrs. W. A. Johnston)	27·0	23·5
Pawngilly (R. P. Mathews)	30·0	28·3
Mossman (Souter Estate)	36·0	34·0
Bartle Frere (Knust & Knust)	27·5	27·1
Euramo (L. Mylonas)	32·9	26·3
Lower Tully (S. J. Dallachy)	27·8	20·8
Silkwood (C. Sosso)	27·2	21·6
Cowley (P. Hrstich)	23·7	19·5
Moresby (E. Zaffanato)	21·8	21·2
Garradunga (Cassella & Tornabene)	17·1	12·5
Japoon (J. Borg)	20·3	16·7
Mourilyan (P. Garrone)	24·2	23·3
Innisfail (J. Erceg)	43·1	40·3
Innisfail (P. J. Riordan)	43·7	39·9
Silkwood (W. L. Poustie)	33·5	29·2
El Arish (J. C. Proctor)	29·6	25·3
Palmyra (W. McKay)	38·8	35·8
Mia Mia (R. E. Kelly)	20·0	19·8
Mackay (H. Johansen)	23·2	22·0
Proserpine (G. Edwards)	30·0	29·3
Oakenden (Butt Bros.)	13·8	9·5
Walkerston (Ritchie Bros.)	14·9	14·4
Alexandra (L. Galea)	36·2	35·2
Koumala (S. Pedersen)	30·0	27·5
Palms (Somers & Sons)	35·3	35·1
Peri (Christansen Bros.)	26·8	24·5
North Eton (Baulch Bros.)	15·6	15·5
Proserpine (R. Staniland)	28·0	26·0
Proserpine (E. Dray)	19·3	19·0
Sarina (J. Laurie)	18·8	18·5
South Kalkie (S. Vecchio)	47·6	42·5
South Kalkie (E. C. Taske)	41·6	34·3

(*b*) Trials not showing response to lime.

Location.	Yield (tons Cane per Acre).	
	Lime Plot.	No Lime.
Mossman (H. J. Hill & Son)	28·6	28·8
Mourilyan (C. & M. Ghietti)	20·3	22·6
Mourilyan (E. S. Edgerton)	36·3	38·5
Mundoo (E. Prete)	24·5	26·7
Glenella (Grant & Grant)	19·1	19·4
Sarina (E. J. Brewer)	21·1	22·2
Erakala (Holmes Bros.)	19·2	19·3
Lagoons (W. Walker)	24·2	26·3

Lime plus fertilizer trial.

The second ratoon crop of the lime plus fertilizer trial on Mr. M. Lauridsen's property, Gordonvale, was harvested during the season. As

in the case of the first ratoon crop (to which the lime was originally applied) a definite beneficial effect occurred due to the lime treatment. It may be pointed out that while lime was applied to the first ratoon only, the fertilizer dressings were given to both first and second ratoon crops. The lime and fertilizer applications given were as follows:—

Treatment No. 1.—2 tons agricultural lime per acre.
Treatment No. 2.—2 tons agricultural lime per acre plus 6½ cwt. mixed fertilizer per acre.
Treatment No. 3.—6½ cwt. mixed fertilizer per acre.
Treatment No. 3.—No lime and no fertilizer.

The yield figures for both ratoon crops are given in Table 4.

TABLE 4.

* Results of Lime+Fertilizer Trial (Cane tons per acre).

—	Lime.	Lime + Fert.	Fert. only.	No Lime — No Fert.
First Ratoon	17·3	23·2	22·0	14·4
Second Ratoon	11·4	23·2	21·6	8·9
Total	28·7	46·4	43·6	23·3

* In this 4 x 6 randomised trial, the response to lime and fertilizer was significant for both crops. There was no significant interaction.

The figures indicate that the dressing of lime was responsible for an increase of 4–5 tons of cane over the two crops. Although this increase would not be equal in net monetary value to 2 tons of lime per acre, it should be remembered that the beneficial effect will be noticeable in this soil for several years. Furthermore, without doubt, this application has prevented any tendency towards a further increase in soil acidity which may have brought about a more pronounced decrease in yields.

In this trial there was a very marked response to the application of a mixed fertilizer. It is interesting to note that in both crops the yields due to the application of lime alone were considerably less than those where fertilizer alone was used. The best returns occurred where both lime and fertilizer were applied.

FERTILIZER TRIALS.

Mr. L. Galea's Farm, Alexandra, Mackay.

The first ratoon crop of the trial on the above property showed similar responses to those reported last year (Quarterly Bulletin, April, 1947). Once again, cane growing in this soil showed a marked benefit from the application of ammonium sulphate as a side dressing.

Response to Superphosphate and Potash.

The response to superphosphate and muriate of potash was not well defined, although the heavier dressings did appear to increase the sugar content somewhat. However, apparently this soil is still well supplied with phosphoric acid, and therefore only light dressings of these two fertilizers are required in order to maintain the present satisfactory levels.

Response to Nitrogen.

The figures given below indicate the responses due to the amounts of ammonium sulphate.

RESULTS DUE TO AMMONIUM SULPHATE.

Ammonium Sulphate per Acre.	Crop Yields.		Net Profit per Acre due to Fertilizer.
	Cane, tons per Acre.	C.C.S. in Cane.	
			£
No ammonium sulphate	13·88	17·32	..
200 lb. ammonium sulphate	18·11	17·61	10
400 lb. ammonium sulphate	21·86	17·27	17

The value of ammonium sulphate to ratoon cane is strikingly illustrated by the above figures. After deducting the cost of fertilizing and extra cutting costs, an application of little over two bags of ammonium sulphate resulted in an increased net profit of £17 per acre.

Mr. H. Hinton's Farm, Rosella, via Mackay.

A fertilizer trial was harvested on the above property during the year. In this trial, which was carried out on a plant crop of Q.28, three different levels of ammonium sulphate, superphosphate, and muriate of potash were used. These were as follows:—

1. Ammonium sulphate—nil.
2. Ammonium sulphate—200 lb. per acre.
3. Ammonium sulphate—400 lb. per acre.
4. Superphosphate—nil.
5. Superphosphate—200 lb. per acre.
6. Superphosphate—400 lb. per acre.
7. Muriate of potash—nil.
8. Muriate of potash—120 lb. per acre.
9. Muriate of potash—240 lb. per acre.

The ammonium sulphate was applied in the usual manner as two side dressings during the mid-summer months, while the superphosphate and potash were applied in a drill shortly after planting.

Response to Superphosphate.

When the field was harvested the yield figures indicated that the addition of superphosphate had not brought about an increase in tons of cane per acre, nor had it significantly affected the sugar content. The yields and C.C.S. figures for the different superphosphate applications are as follows:—

(*a*) No phosphate plots yielded 25·3 tons per acre at 16·34 C.C.S.

(*b*) 200 lb. (per acre) phosphate plots yielded 24·5 tons per acre at 16·57 C.C.S.

(*c*) 400 lb. (per acre) phosphate plots yielded 24·6 tons per acre at 16·83 C.C.S.

It would appear, therefore, that the soil itself was capable of supplying all the phosphoric acid required for a successful crop of cane. Since this was most likely due to the carry-over effect of past fertilizing, it will be interesting to observe the behaviour of the plots receiving no phosphate in the ratoon crops.

Response to Nitrogen and Potash.

The trial showed that there was a very close relationship between the effects due to ammonium sulphate and muriate of potash. It was quite evident that the application of nitrogen alone did not increase the yield unless potash was also applied and, *vice versa*, no benefit was obtained from potash unless nitrogen was applied. The figures given below indicate the benefits due to the various combinations of nitrogen and potash.

Ammonium Sulphate, lb. per Acre.	Muriate of Potash, lb. per Acre.	Yield of Cane, tons per Acre.
Nil	Nil	22·25
Nil	120	22·92
Nil	240	21·50
200	Nil	23·00
200	120	24·58
200	240	29·00
400	Nil	24·50
400	120	25·92
400	240	29·58

It will be seen that the greatest yield (29·58 tons) was obtained when the heaviest dressing of ammonium sulphate was used in conjunction with the heaviest dressing of potash. However, a similar yield (29·00 tons) was obtained with the medium dressing of nitrogen (200 lb. ammonium sulphate) and the heaviest dressing of potash. Obviously, this would be the most economical mixture to use. The difference between this and the yield with no fertilizer (22·25 tons) is approximately 7 tons of cane per acre, which would amply repay the cost of the extra fertilizer.

A New Use for Molasses.

According to a recent Australian Veterinary Journal the oxidation of arsenical dipping fluids can be prevented by the addition of molasses. One of the drawbacks of the ordinary cattle dip is that the arsenic becomes oxidised by exposure to the air and gradually loses its tick-killing properties. If this oxidation could be prevented the life of the dip would be considerably prolonged and the addition of more arsenic to maintain its strength would be unnecessary.

It has been found by experiment that the addition of as little as 2 gallons of molasses about twice a year is probably sufficient to maintain the normal dip free from oxidation.

N.J.K.

Varietal Trials.

By Norman J. King.

IN the January, 1948, issue of the Bulletin were published results of several varietal trials harvested in the sugar belt during 1947. Results of all trials were not in hand when the January number went to press and those which arrived late are shown below. Some of the trials were affected by the 1946 drought and the abnormal seasonal conditions in early 1947, while others produced excellent crops which showed the capabilities of the varieties under test. Varietal trials carried out on the three Experiment Stations are also included.

Mr. T. Tolentini's Farm, Mossman.

Soil Type.—Granitic alluvial. **Nature of Crop.**—First ratoon.
Age of Crop.—13 weeks. **Harvested.**—September, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Plant Crop.		First Ratoon Crop.		Summary.	
	Cane per acre.	C.C.S.in cane.	Cane per acre.	C.C.S. in cane.	Total Crop.	Total Sugar per acre.
	Tons.	Per cent.	Tons.	Per cent.	Tons.	Tons.
Eros	28·2	17·6	30·1	16·5	**58·3**	**9·93**
Trojan ..	28·7	16·2	17·2	15·7	44·4	7·35
P.O.J.2878	23·5	15·7	25·6	14·3	49·1	7·35

DISCUSSION.

From the start of ratooning P.O.J.2878 was ahead of Eros with Trojan ratooning poorly and slowly. Four months after cutting Trojan was still backward while P.O.J.2878 was most impressive of the three. In May Eros and P.O.J.2878 started to arrow and although there appeared to be little to choose between them the Eros was slightly thicker. Trojan, as usual, made some winter growth and tonnages at harvest were not very different. In the aggregate of the two crops Eros produced the greatest tonnage of cane and sugar per acre while P.O.J.2878 was equal to Trojan.

Dispersed varietal trial on farms of Fixter Bros., Hesp Bros., Johnson Bros., and Vessey and Son.

Fixter Bros., Aloomba.

Soil Type.—Old alluvial. **Nature of Crop.**—Plant cane.
Age of Crop—15½ months. **Harvested.**—September, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Trojan	**19·5**	16·25
B.212	18·0	**16·59**
Cato	14·4	16·15
B.338	19·3	15·65
Q.53	13·3	15·60

Hesp Bros., Aloomba.

Soil Type.—Red-brown schist. **Nature of Crop.**—Plant cane.
Age of Crop.—17 months. **Harvested.**—October, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Trojan	**28·3**	16·60
B.212	26·3	16·27
Cato	23·4	16·38
B.338	23·3	**17·14**
Q.53	24·0	16·65

Johnson Bros., Gordonvale.

Soil Type.—Schist. **Nature of Crop.**—Plant cane.
Age of Crop.—17 months. **Harvested.**—October, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Trojan	**32·6**	15·38
B.212	25·7	17·27
Cato	28·5	17·35
B.338	26·0	**18·18**
Q.53	26·9	17·17

Vessey and Son, Edge Hill.

Soil Type.—Schist. **Nature of Crop.**—Plant cane.
Age of Crop.—16 months. **Harvested.**—September, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Trojan	**33·7**	14·44
B.212	28·5	16·85
Cato	25·0	16·87
B.338	22·4	**18·30**
Q.53	23·7	17·52

SUMMARY OF RESULTS ON FOUR FARMS.

Variety.	Average Cane per Acre.	Average Sugar per Acre.
	Tons.	Tons.
Trojan	**28·54**	**4·44**
B.212	24·62	4·12
Cato	22·81	3·83
B.338	22·76	3·96
Q.53	21·98	3·71

DISCUSSION.

In all four trials Q.53 and Trojan gave the best germinations. Early growth records show that a very dry summer was experienced and Trojan resisted the drought best although Q.53 made best early growth. Cato was hardest hit by the dry weather and all varieties except Trojan tended to stool above the ground. As in all other trials Trojan made best late growth when lower temperatures were experienced and when the growth of other varieties tended to slow down. In tons of sugar per acre Trojan and B.212 were superior to the other varieties, there being little to choose between the other three. The performance of the ratoons in a season of less harsh conditions will be watched with interest.

Northern Sugar Experiment Station, Meringa, Block A.5.

Soil Type.—Grey forest loam.
Age of Crop.—13 months.
Nature of Crop.—Plant cane.
Harvested.—September, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.	Sugar per Acre.
	Tons.	Per cent.	Tons.
D.233	**30·9**	15·14	4·28
Trojan	30·8	**17·17**	4·80
D.271	30·2	16·59	**4·86**
D.216	29·2	16·78	4·67
Q.44	28·1	13·62	3·58
D.225	28·1	15·18	3·99
D.287	26·6	15·46	4·07
D.221	25·6	16·87	4·71

DISCUSSION.

Germinations in this trial, planted under good conditions, favoured Q.44, D.221, Trojan and D.271, but all varieties were over 90 per cent. From August to December a drought prevailed, but thereafter, despite the absence of a normal wet season, all canes made fair progress. There was little to choose between any of the canes and none was outstanding at any stage of the crop. D.233 lodged badly and both it and D.287 produced very poor cover. The latter cane was damaged by wallabies. D.221 suffered somewhat from grub damage. Trojan, D.271 and D.216 gave the best return of sugar per acre.

Sugar Experiment Station, Mackay, Block A.5.

Soil Type.—Sandy loam to silty clay loam.
Age of Crop.—15 months.
Nature of Crop.—Plant cane.
Harvested.—October, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Cane per acre.	C.C.S. in Cane.	Sugar per acre.
	Tons.	Per cent.	Tons.
Q.50	**19·11**	**18·70**	**3·58**
Q.28	15·49	18·13	2·81
B.174	15·12	18·27	2·76
P.O.J.2878	12·81	17·50	2·23
Trojan	7·57	17·68	1·33

DISCUSSION.

Germination counts were recorded for all plots and analysis of the figures indicated that B.174, Q.28 and Q.50 were significantly better than both P.O.J.2878 and Trojan. In the early stages of development Q.50, Q.28 and B.174 were in better condition than the others, the dry spell adversely affecting Trojan particularly. By February Q.50 was well ahead while Trojan had a poor stool. The same order persisted into the winter and Trojan at this stage showed considerable banded sclerosis. In tons of sugar per acre Q.50 significantly exceeded all other varieties at the one per cent. level of significance and all other varieties were significantly superior to Trojan.

Dispersed varietal trial on farms of Mr. C. Zielke, Golchert Bros., and Mr. A. G. E. Hansen.

Mr. C. Zielke's Farm, Bundaberg.

Soil Type.—Red volcanic.
Age of Crop.—13 months.
Nature of Crop.—Plant cane.
Harvested.—October, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
C.P.29/116	**23·9**	**13·9**
Q.52	22·5	13·3
Q.28	18·0	12·2
Co 290	18·3	10·8

Messrs. Golchert Bros.' Farm, Barolin Road.

Soil Type.—Red volcanic. **Nature of Crop.**—Plant cane.
Age of Crop.—14 months. **Harvested.**—December, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
C.P.29/116	**27·8**	**13·7**
Q.52	26·2	11·3
Q.28	21·0	12·1
Co.290	19·4	7.9

Mr. A. G. E. Hansen's Farm, Burnett Heads.

Soil Type.—Red volcanic. **Nature of Crop.**—Plant cane.
Age of Crop.—13 months. **Harvested.**—November, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
C.P.29/116	**44.5**	14.9
Q.52	41·4	14·7
Q 28	37·9	**15·2**
Co.290	36·6	14·2

SUMMARY OF RESULTS ON THREE FARMS.

Variety.	Average Cane per acre.	Average Sugar per Acre.
	Tons.	Tons.
C.P.29/116	**32·0**	**4.58**
Q.52	30·0	4·01
Q.28	25·6	3·49
Co.290	24·8	2·90

DISCUSSION.

Germinations were over 90 per cent. in all cases and some plots were up to 98 per cent. Q.52 was even faster than C.P.29/116 in striking, and rapidly established a lead which it retained throughout most of the period of the crop. In the later stages the Q.52 developed red rot, to which it has proved to be most susceptible. In Golchert Bros.' trial this variety suffered 10 per cent, death and 90 per cent. of the sticks had red rot infection. Co.290 also suffered to some extent from red rot infection and the C.C.S. was adversely affected. In tons of sugar per acre C.P.29/116 significantly exceeded all other varieties at the 5 per cent. level and Q.28 was superior to Co.290.

Sugar Experiment Station, Bundaberg, Block A1.

Soil Type.—Red volcanic.
Age of Crop.—12 months.
Nature of Crop.—First ratoon.
Harvested.—October, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Plant Crop.		First Ratoon.		Summary.	
	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.	Total Crop.	Total sugar per Acre.
	Tons.	Per cent.	Tons.	Per cent.	Tons.	Tons.
Q.49	9·6	13·4	27·0	13·8	**36·6**	**5·01**
B.50	10·4	9·9	25·2	13·6	35·6	4·46
B.56	10·3	10·5	25·0	13·7	35·3	4·51
Q.52	9·5	10·8	24·5	12·9	34·0	4·19
Q.28	10·1	10·9	23·9	13·7	34.0	4·37

DISCUSSION.

The summary of two crops from this trial demonstrates again the value of Q.49 under these conditions. The plant crop was produced in a year of bad drought when both crop and sugar content were far below normal. The remarkable recovery in the ratoons demonstrates the recuperative powers of these canes. B.50 and B.56 are two seedlings which are being further propagated for farm trials. The former is very upright and compact and suggests itself as suitable for mechanical harvesting. Q.28 is not particularly promising on these dry, red soils, but it appears more suited for the alluvial conditions.

Sugar Experiment Station, Bundaberg, Block A.2.

Soil Type.—Red volcanic.
Age of Crop.—14 months.
Nature of Crop.—Second ratoon.
Harvested.—December, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Plant Cane.		First Ratoon.		Second Ratoon.		Summary.	
	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.	Cane per Acre.	C.C.S. in Cane.	Total Crop	Total sugar per Acre.
	Tons.	Per cent.	Tons.	Per cent.	Tons.	Per cent.	Tons.	Tons.
Q.49 ..	23·2	15·7	9·7	16·2	29·9	13·7	62·8	9·31
Q.42 ..	27·8	17·0	8·7	15·5	28·3	14·8	**64·8**	**10·26**
Q.52 ..	28·5	15·6	6·1	12·4	27·0	13·2	61·6	8·77
Q.25 ..	21·0	16·2	6·6	14·0	17·9	14·7	45·5	6·96
M.1900 ..	23·0	15·5	No harvestable crop		13·7	13·1	36·7	5·36

DISCUSSION.

This trial was originally designed to demonstrate the superiority of present-day varieties over the old favourite M.1900, which was taken off the approved list because of susceptibility to gumming disease. The three crops covered two fair years and one of extreme drought. In the drought year M.1900 did not produce a harvestable crop and in the succeeding year produced less than half the tonnage of some of the better canes. In the aggregate of three crops Q.42 performed best in tons of cane and sugar per acre, followed closely by Q.49. Q.52 was in third place, but this variety has shown extreme susceptibility to red rot and it can never become a commercial cane in this area.

Dispersed varietal trial on farms of G. Whittaker and Apps Bros.

Mr. G. Whittaker's Farm, Maroochy River.

Soil Type.—Brown alluvial loam. **Nature of Crop.**—Plant cane.
Age of Crop.—15 months. **Harvested.**—December, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
C.P.29/116	41·4	14·4
Q.47	39·9	14·5
Q.28	36·8	14·9
Co.290	40·1	12·2
P.O.J.2878	26·3	15·2

Messrs. Apps Bros.' Farm, Maroochy River.

Soil Type.—Brown alluvial loam. **Nature of Crop.**—Plant cane.
Age of Crop.—13 months. **Harvested.**—November, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
C.P.29/116	40·1	15·0
Q.47	37·0	14·6
Q.28	39·3	15·0
Co.290	34·1	11·7
P.O.J.2878	31·5	14·8

SUMMARY OF RESULTS ON TWO FARMS.

Variety.	Average Cane per acre.	Average Sugar per Acre.
	Tons.	Tons.
C.P.29/116	40·8	5·99
Q.47	38·5	5·60
Q.28	38·1	5·69
Co.290	37·1	4·45
P.O.J.2878	28·9	4·34

DISCUSSION.

Germinations in both of these plantings were, on the whole, satisfactory, although the Co.290 on Apps Bros. was as low as 80 per cent. Q.28 showed the best early growth, while C.P.29/116 and Q.47 had good stool development. Co.290 demonstrated excellent vigour at certain periods but was inclined to show distress in dry periods and had considerable red rot at harvest. There was little to choose between C.P.29/116, Q.47, Q.28 and Co.290 at harvest, but all were superior to P.O.J.2878. The lower sugar content of Co.290 made it less profitable than the other three in sugar per acre, C.P.29/116 being the best performer with Q.47 second and Q.28 third.

Dispersed varietal trial on farms of Messrs. C. and G. Palu and E. H. Churchward.

Messrs. C. and G. Palu's Farm, North Gooburrum.

Soil Type.—Red sandy loam. **Nature of Crop.**—Plant cane.
Age of Crop.—16 months. **Harvested.**—December, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Q.52	**44·9**	9·65
Q.49	32·9	13·20
Q.47	33·0	13·14
P.O.J.2878	23·9	**13·84**

Mr. E. H. Churchward's Farm, Gooburrum.

Soil Type.—Red sandy loam. **Nature of Crop.**—Plant cane.
Age of Crop.—13 months. **Harvested.**—October, 1947.

SUMMARY OF CROP YIELDS.

Variety.	Cane per Acre.	C.C.S. in Cane.
	Tons.	Per cent.
Q.52	**30·4**	13·75
Q.49	27·9	15·12
Q.47	26·2	15·60
P.O.J.2878	21·9	**15·81**

SUMMARY OF RESULTS ON TWO FARMS.

Variety.	Average Cane per Acre.	Average Sugar per Acre.
	Tons.	Tons.
Q.52	**37·65**	4·26
Q.49	30·39	**4·28**
Q.47	29·60	4·21
P.O.J.2878	22·86	3·38

DISCUSSION.

Germinations were all over 92 per cent. in Churchward's trial, but P.O.J.2878 was only 85 per cent. in Palu's block, with the other varieties ranging between 92 and 95 per cent. Early growth favoured Q.52 in all plots and this variety maintained its lead throughout. At harvest time there was 30 per cent. red rot infection in Palu's, although no stalks were dead, and 5 per cent. infection in Churchward's. The recumbent nature of the Q.52 on Palu's affected the sugar content adversely. There was little to choose between Q.47 and Q.49 at any stage of growth, but on Palu's trial the P.O.J.2878 was always backward. In sugar per acre P.O.J.2878 was significantly exceeded by the other three varieties. The third leg of this dispersed trial was rendered valueless by errors in truck weighings. Q.52 has unfortunately exhibited extreme susceptibility to red rot infection and will not become an approved variety.

The Hot-Water Treatment of Plants on the Farm.

By C. G. Hughes.

THE disease known as chlorotic streak is the most insidious of all the diseases occurring in Queensland cane fields. Its most obvious symptoms, and they are comparatively inconspicuous, are the whitish disjointed streaks on the leaves showing for a period of a few months during the early part of the growing season. Less obvious but much more serious are the poor germinations and the losses in tonnage directly attributable to the disease. At present the disease is known to occur in all the far northern mill areas and at Moreton and Rocky Point in the south. Many of the important or potentially

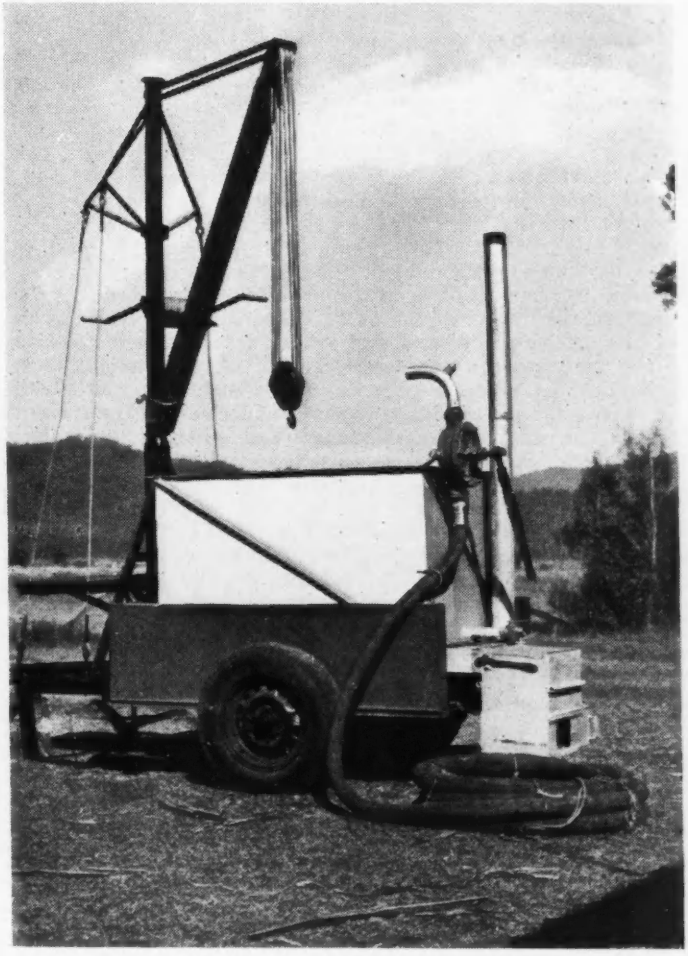
[*Photo. C. G. Hughes.*

Fig. 54.—Illustrating treatment tank in use. Bags of plants being lowered into hot water.

important commercial varieties—e.g., Badila, P.O.J.2878, Q.28, Q.44, Trojan and Vesta—are susceptible to the disease and in the wetter areas are suffering considerable reductions in tonnage. In this connection it is of interest to note the big differences in yield between healthy and chlorotic streak diseased plots of P.O.J.2878 in a trial just harvested at Maroochy River, Moreton Mill area. Differences were of the order of 10 tons per acre in a twenty-four-month-old plant crop. Similar trials

with Badila some years ago in the far north also showed large differences: in one, the diseased plots averaged 21 and the healthy 32 tons per acre. There is no doubt that over large areas in the north chlorotic streak is seriously reducing the yield of susceptible canes and the aggregate losses undoubtedly run into tens of thousands of tons each year—a greater loss than that caused by all other diseases combined.

There is, however, some hope in the fact that the disease, serious as it is, can be readily controlled, at least in the plant crop, by the hot-water treatment of the planting material. Immersion of the setts



[*Photo. J. H. Buzacott.*

Fig. 55.—Close-up of treatment tank, showing pump, stove, and crane.

or sticks in water at a temperature of 52°C. (i.e., 126°F.) for twenty minutes will "cure" the disease and the setts will then give rise to healthy plants. There are obvious difficulties in treating large amounts of planting material, although in Queensland a good deal of cane for experimental work has been treated in tanks or drums heated by steam or hot water from the mills during the crushing. In Hawaii some plantations have gone in for the hot-water treatment of plants on a large scale, and one establishment is capable of handling 2,000 bags of setts per day. There may be a place here in Queensland for such a plant worked in conjunction with a mill and in a district where it would be a comparatively simple matter to transport all cane for plants to the mill. In the meantime, however, the Bureau is experimenting with a portable tank with built-in heating unit which may be taken to the farm for the treatment of plants on the spot.

The tank, which is of a type used by the R.A.F. for cleaning aeroplane parts after storage, is of galvanized steel and measures 4 feet 8 inches long by 3 feet 2 inches wide by 2 feet 9 inches deep. It is sufficiently braced to resist distortion when full of water. The tank has been mounted on a light two-wheel trailer (see Fig. 55) and fitted with various accessories for handling the water and the plants. Water is brought into the tank from any convenient creek or waterhole by means of a 2-inch semi-rotary pump sucking through 60 feet of hose. The heating unit consists of a flue beneath the tank running to a chimney made from two lengths of 4½-inch stove piping. It is heated by a stove sliding into the flue from the back. The bottom of the stove is only a few inches from the ground, and on this account the stove is removed from the flue when the plant has to be shifted. The weight of the full tank is borne by a series of jacks, one at each corner of the trailer, screw-operated, and resting on hardwood blocks. At the forward end of the tank a crane with a swinging boom, windlass mechanism, and block and tackle is rigged. The upright to which the boom is attached is pivoted at the level of the top of the tank so that the crane can be folded in a backward direction and so made to rest on the tank when travelling. Test runs have shown that six bags of plants—this tank is not quite long enough to take full-length sticks—can be handled by the plant at the one time, and that about fifty bags could be treated in the one day. The plant is shown in action on a farm in the Moreton Mill area in Fig. 54; one batch of six bags is lying on the ground after treatment and another one is about to be lowered into the water. The thick undergrowth in the background hides a small gully running into Petrie Creek.

The portable hot-water plant should yield some interesting results in the research work on the disease and in attempts to evolve some practical way of controlling the disease on the farm. In parenthesis, it might be pointed out that the simple, sturdy lifting apparatus should be quite useful in treating setts with mercurial fungicide for the control of pineapple disease.

Unauthorised Cane Variety Plantings.

By R. W. Mungomery.

It has recently come to our notice that a few growers have thoughtlessly planted non-approved varieties or have transferred cane for planting purposes from one major quarantine district to another without first obtaining the necessary permit.

It will be opportune to point out here that both actions are offences against "*The Sugar Experiment Stations Acts*, 1900 *to* 1947," and any persons found guilty are liable to penalties up to £100 for either offence.

The regulations prohibiting such plantings or transfers were framed solely for the purposes of protecting the sensible majority of cane-growers from the actions of the thoughtless few "Variety-Kings," who in their endless search for new varieties are just as likely to introduce new pests and diseases with their new finds. So, apart from the penal aspect, and the fact that they are liable to introduce a serious disease on to their own farms, either of which in itself should be a sufficient deterrent, growers should realise that they have a moral obligation towards their neighbours and not jeopardise their livelihoods by senseless dabbling in varieties which should not concern them.

Recently, in the course of our field inspections, we came across an instance where a farmer was growing in his garden plot a gum-susceptible variety which had been discarded as a commercial variety years ago, and he was fondly deluding himself that it might prove a "super" cane. In this case he had resurrected it from a nearby dairying district where it was being used for fodder purposes.

In the past, sugar cane varieties have failed either because of extreme disease susceptibility, low quality and yield, or bad agricultural attributes, and it can be taken as axiomatic that if any of the older varieties had been at all worth while they would have survived to the present day (witness the value and continued popularity of Badila over the last fifty years), whilst to reintroduce, and grow on a large scale, any variety that has gone out through one or other of the above disabilities is surely courting certain disaster.

During the past few months, one unauthorised transfer which we fortunately intercepted in transit involved sugar cane from the Northern Rivers district of New South Wales which was being sent to an area between Rockhampton and Mackay. Imagine what might have happened if even one stick of this cane were infected with Fiji disease (which is quite possible) and the consignment had been planted without our knowledge! It is most likely that Fiji disesase would have become established in the farms bordering the railway line, and it would have been extremely difficult to prevent the disease from eventually reaching the extensive cane-growing area of the Mackay district. Similarly, canes have been either sent or taken from North Queensland to some of the more southern sugar areas, and it should scarcely be necessary to point out the danger in such instances of spreading leaf-scald and chlorotic streak diseases to otherwise clean areas.

Lists of varieties approved for planting in different mill areas are drawn up yearly, and these provide each grower with a fairly broad choice of varieties which should give him the most profitable return under the conditions operating in his particular district. These lists are added to from time to time as superior varieties are introduced and brought into prominence as a result of our field trials, whilst inferior varieties are discarded as soon as it is evident that they have become unpopular. However, it should be appreciated and remembered that all varietal introductions should be left in the safer hands of Bureau officers.

Approved varieties are the ones in which the progressive grower should interest himself, and if he requires any information about them, or details concerning a reliable source of plants, he has merely to contact our nearest field officer when his requests will receive the necessary attention.

British Ferguson Tractors.

Some publicity has recently been given to the fact that a supply of Ferguson Tractors will reach Australia during 1948. Mr. Bruce Cousens, representing the Export Division of the Ferguson Tractor Co. Ltd., England, has stated that over 4,000 of these farming tractors will be imported into Australia this year.

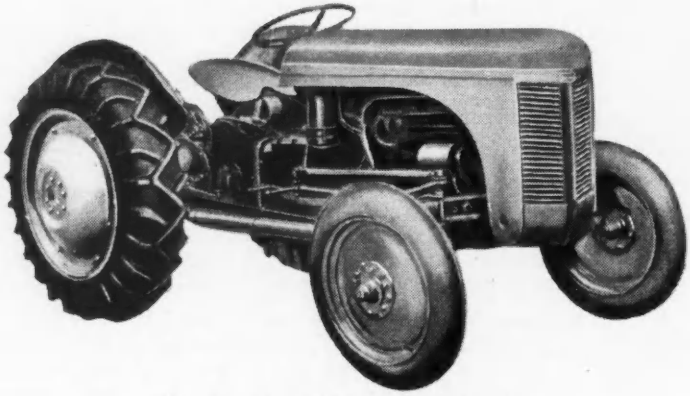


Fig. 56.—The British Ferguson Tractor.

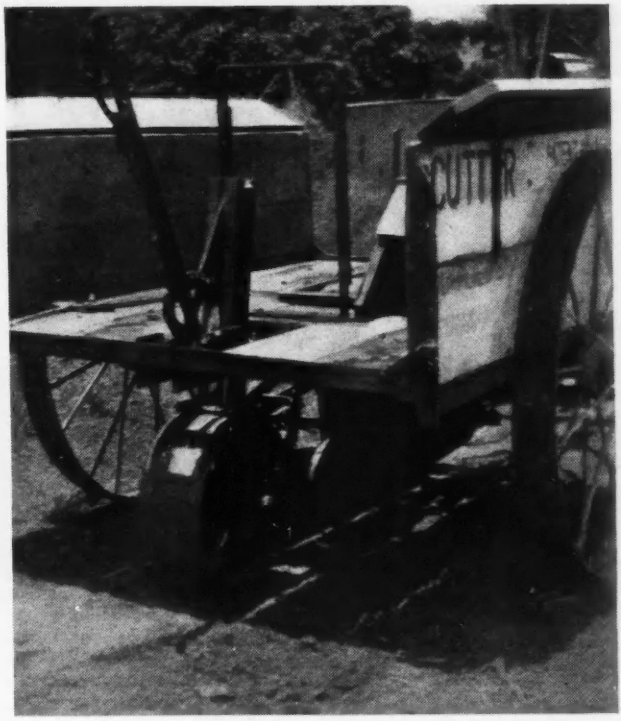
This model wheel tractor is of 24 h.p. and is built in Coventry, England. It incorporates finger-tip hydraulic control of implements, self-starter, &c., and is claimed to possess the latest features of tractor development. The photograph shows a conventional pneumatic wheel design, but no details are available regarding clearance, &c. The arrival of such a number of tractor units should do much to relieve the tractor shortage in all parts of Australia.

N.J.K.

Consolidation of Soil in Drills after Planting Cane.

By G. A. Christie.

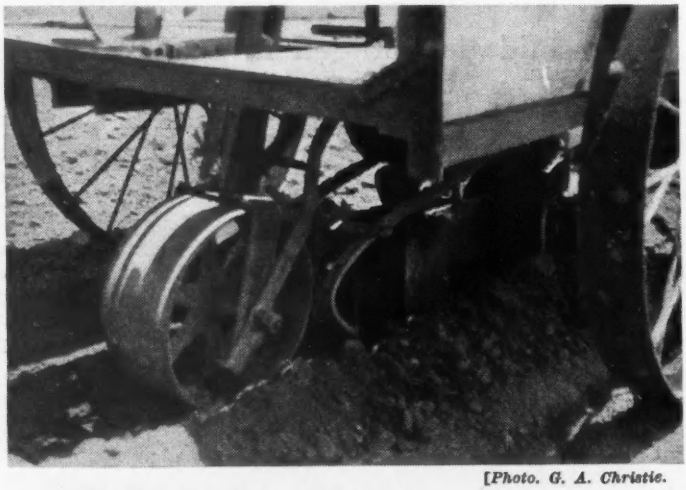
In an article in the "Canegrowers' Quarterly Bulletin" of October, 1947, various methods of consolidating soil in cane drills after planting were discussed. It was stated that rollers, chains or logs drawn behind the planter were usually too light to provide sufficient firming of soil about the plant. This has been overcome to a large extent by a canegrower of Home Hill, Mr. C. W. Jordan, who has designed an attachment for planters, in which part of the weight of the planter is used to exert pressure on the soil by means of a wheel mounted at the rear of the planter. The method of attachment is shown in the accompanying photographs.



[*Photo. G. A. Christie.*

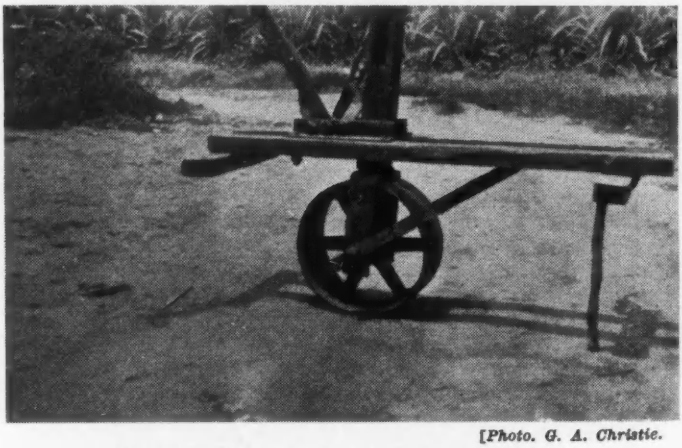
Fig. 57.—Illustrating how the compacting wheel is built into the planter.

The wheel illustrated is 15 inches in diameter and has a 6-inch face. The width of the face of the wheel is somewhat too great, and it is thought that 3 or 4 inches would be a better figure. The wheel must be lifted from the drill when turning at headlands and lowered to the required pressure on the soil when the drilling mouldboards are lowered.



[*Photo. G. A. Christie.*

Fig. 58.—The planter in action with compacting wheel.



[*Photo. G. A. Christie.*

Fig. 59.—Wheel assembly removed from planter.

This is done by a simple lever connecting the vertical wheel mounting with a hand lever, obtained from a discarded implement. The hand lever is placed in such a position that it is convenient for the operator while not affecting loading or planting operations.

The vertical wheel mounting passes close to the face of the pulley wheel, and this acts as a scraper to remove soil which might stick to the wheel under moist planting conditions. The unit is mounted on the rear frame of the planter and so part of the planter weight can be used to press the soil after the plant has been placed on the ground. Raising and lowering the wheel at headlands is a much easier job than manipulating rollers or logs, especially where machines have to be backed for loading or commencing a new row.

A Useful Method for Conservation of Trash.

By J. H. Buzacott.

THE disposal of trash from cane crops which are cut green has always presented a problem to the farmer who desires to conserve it and not to burn it. Two common methods used to conserve trash in the past were (*a*) rolling it into every second or third row and subsequently cultivating the exposed interspaces only; (*b*) chopping the trash into the soil with a rotary hoe. The objection to the first method is the cost of hand rolling if it is accomplished by men using poles and the blowing about of the trash if the side delivery rake is used. The principal objections to the second method are that, if carried out at a dry time of the year, drying out of the soil is accentuated and in addition some nitrogen starvation is probable due to the available nitrogen in the soil being temporarily employed in breaking down the trash.

[*Photo. J. H. Buzacott.*

Fig. 60.—Field in which trash was cut up with the Cotton King and left on the surface, after which the grubber could pass through.

Recently in North Queensland a useful method was observed for dealing with trash. Due to showery winter weather and the consequent crops of "blue top" along the interspaces of many Trojan crops, considerable areas are being cut in the leaf this year. On a river flat farm where this is occurring the farmer, desirous of returning the trash to the soil, has very effectively used a cotton king for the purpose. The machine is an old one in which the discs have worn down so that

there is now very little "dish" in them; furthermore, they have worn very sharp. The pole has been removed and a short one, suitable for attachment to a tractor, is fitted in its place.

In action the cotton king is weighted with two or more bags of soil and a fair cut is placed on the discs which are set to throw away from the cane. The discs are also adjusted to the maximum vertical angle so that the inside discs cut much deeper than the outside ones.

The cotton king is easily pulled with a light tractor and could probably be pulled with two horses although no information in available on this point. The inside discs penetrate to practically 6 inches in depth and no trouble is experienced with choking up. The practice is to use the cotton king twice at an interval of some weeks after which the grubber can be passed through. Care should be exercised in good growing weather that the second cotton-king operation does not cut off newly-developed roots. Since the trash is actually chopped up on top of the soil it acts as an excellent mulch and neither the drying out nor the nitrogen starvation which result from rotarying the debris into the soil are experienced. Crops treated in this manner have grown excellent ratoons. The treated blocks which were observed cut approximately 35 tons per acre as a plant crop so that a fair body of trash was present.

Whilst this method has proved highly successful on river flats where the soil is fairly firm it may not be applicable to the lighter soils such as the red volcanics in which the soil may not provide sufficient resistance for the discs to cut; however, it should prove a useful method for those farmers who have the stiffer soils with which to contend particularly in those areas where, on account of the weather, some crops are still cut green.

Sugar Experiment Stations Advisory Board.

The Sugar Experiment Stations Advisory Board met in the room of the Minister for Agriculture and Stock (the Hon. H. H. Collins), on Thursday, 26th February, 1948. The full Board was present, consisting of the Minister (as Chairman), Messrs. J. W. Inverarity and J. C. Collier (millers' representatives), W. L. Poustie and L. G. Scotney (growers' representatives), and E. R. Behne (Director of Sugar Experiment Stations).

The Board discussed at length the proposal to send officers overseas to investigate special problems, and approved that Mr. J. L. Clayton, Senior Mill Technologist, and Mr. L. G. Vallance, Senior Soils Technologist, leave as soon as possible. Mr. Clayton will visit Hawaii to investigate certain manufacturing problems while Mr. Vallance is to enquire into soil deterioration in several overseas countries.

Gratification was expressed by the Board regarding the success of the recent Sugar Agriculture and Tractor School held at Gatton College for young sugar farmers, and also at the progress made in establishing the post-graduate course in Sugar Technology at the University.

Some concern was expressed regarding the unfavourable Fiji disease position in certain southern areas and the possibility of further control action is to be investigated.

The remainder of the business dealt with by the Board was formal.

Droopy Top Disease of Sugar Cane.

By D. R. L. Steindl.

THE name "Droopy Top" has been given to a comparatively recently recorded, and not very widely distributed, disorder of sugar cane. The trouble has been observed periodically in the Moreton area since about 1936, where it has occurred chiefly in the variety Co.290 on the poorer sandy type of soil. However, during the past couple of years it has also been recorded in Q.28, Q.42 and C.P.29/116. P.O.J.2878 appears to resist the trouble, but the reaction of other varieties is not yet known. The general symptoms of the affection as it occurs in Co.290 consist of :—

1. Longitudinal chlorotic stripes on the leaves between the major vascular bundles, with the tissues adjacent to the major bundles remaining green, thus producing an effect of alternating green and creamy-white parallel stripes. In older leaves the margins and tips become withered, and many leaves are attacked by eye spot, ring spot and leaf freckle. The leaves also die prematurely, leaving a column of dead leaves hanging on the stem. See Fig. 61.

2. The youngest leaves are very slow unfurling, thus forming a long, tightly wrapped spindle which droops over, together with the rest of the top. The tissues of the young leaves and stem appear to lack rigidity, and in some cases young sticks almost lie on the ground. More

[*Photo. C. G. Hughes.*

Fig. 61.—Droopy top disease. Note prematurely dead leaves hanging around the stem.

[*Photo. C. G. Hughes.*

Fig. 62.—Severely affected stools in foreground. Cane at rear is the same age.

[*Photo. C. G. Hughes.*

Fig. 63.—Note the healthy and diseased cane in adjacent rows.

mature sticks are upright, but often bend outwards, and the general effect is that the whole stool has a drooping appearance. This drooping appearance is more pronounced in Co.290 than in other varieties.

3. Severely affected stools are very stunted and often killed altogether. The stunting occurs in patches which may be a chain or more in diameter, but usually are less. In the centre of these patches the stools may be mere grassy tufts, while towards the outside they increase in height to that of the normal cane, thus producing saucer-shaped depressions in the field. In some instances, odd well-grown stools, or rows of stools occur in the stunted areas. See Figs. 62 and 63.

Cuttings from affected sticks of several varieties have been planted in the pathology plot at Brisbane. These cuttings have produced quite normal plants which have been growing for a period of two years without showing any symptoms of the complaint. This points to the fact that the disorder is not a disease which can be transmitted through the sett, but is probably caused by some mineral deficiency in the soil.

Droopy Top has been observed on the top of hills, on hill sides and on low-lying land, but in each instance the soil types have been similar, that is, a light grey sandy soil with a yellowish or reddish sandy subsoil. The actual depth of surface soil varies considerably, but no correlations have been noted between this and the occurrence of the poor patches.

At first the trouble was thought to be due to manganese deficiency similar to that which occurs in Hawaii. However, applications of manganese sulphate and sulphur to affected patches have not given any indication of overcoming the disorder. More recently, trials with several minor elements have been put out, and there is a suggestion that copper and zinc combined will stimulate growth on these weak patches. The results are by no means conclusive, and further trials will have to be completed before any recommendations can be made.

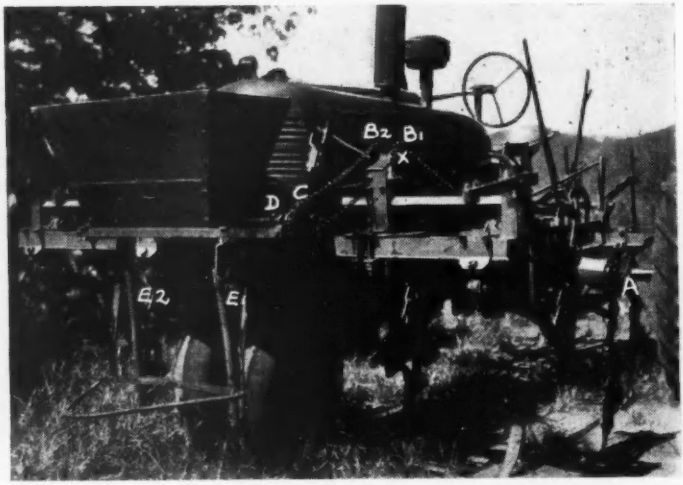
A Fertilizer and "Gammexane" Distributor.

By E. V. Humphry.

Until current experiments give more precise information as to whether drill dressings are to be preferred to broadcast dressings in the application of "Gammexane" dust to canefields for grub control, or *vice versa*, growers have been advised against incurring any considerable expenditure in purchasing new machines for drill dressings at this juncture, but to adapt as far as possible their existing fertilizer distributors for applying this substance. Consequently, large numbers of different distributors were brought into commission, and as this was the first year in which growers used "Gammexane" dust on a large scale, many used their ingenuity in devising some easy method for its application.

The best machine the writer has seen is that built and used by Mr. W. Hamilton on the farm of Archibald and Hamilton, Meringa, It consists of a double row fertilizer box from a Massey-Harris distributor fitted on to the front cultivator bar of a model "M" Farmall tractor. (See Fig. 64.) The drive is taken by chain from a sprocket (A) mounted

on the back axle to a shaft (X) mounted on the front cultivator bar. A tension roller is fitted on a bracket bolted to the tractor, and this keeps the chain taut. At each end of the shaft are two interchangeable sprockets. The outside sprocket (B1) is driven from the back axle and the inside one (B2) drives the sprocket (C) on the fertilizer box. The sprockets B1 and B2 on the shaft are interchangeable to allow the gear ratio to be lowered or increased and so regulate the amount of fertilizer or "Gammexane" to be applied per acre. This grower has five or six sprockets of different sizes, and he can apply "Gammexane" dust as low as 40 or 50 lb. per acre with the lowest gearing. With a smaller sprocket, of course, he could apply it at an even lighter rate. The star wheels inside the box are also interchangeable, and the rate of flow can be adjusted by these wheels also. A clutch (D) between sprocket C and



[*Photo. E. V. Humphry.*

Fig. 64.—The fertilizer and "Gammexane" distributor attached to a conventional tractor.

the box can be engaged or disengaged from the seat by a lever, and allows the machine to be thrown out of gear for turning on the headlands and travelling. Two flexible concertina pipes (E1 and E2) lead down from each side of the box, and these can either be allowed to hang or be fixed in position to a frame bolted to the cultivator bar. By either raising or lowering them or placing them further apart the spread can be adjusted as desired. Being flexible there is no danger of the pipes clogging. As this model straddles two rows, the powder is applied on each side of the interspace, and a trash guard is fitted in front of the two pipes E1 and E2 to prevent tangling of leaves and trash. Another advantage is that the powder in the box does not pack as in some machines, as the vibration of the tractor keeps it loose, thus ensuring an even flow.

At the first demonstration the grower was applying sulphate of ammonia at the rate of 3 cwt. per acre; the application was very even and was well mixed with the soil by the cultivator tynes on the tractor.

The unit worked equally as well when the box was filled with "Gammexane" dust and the gearing lowered by fitting a smaller sprocket B2 on to the shaft X. The application was at the rate of 98 lbs. per acre and, as he was working at the same speed as when applying sulphate of ammonia, he would be capable of doing 20 acres per day. If the application is left until the cane needs cultivating, both operations can be done at once.

With modification, this unit could be mounted on other makes of tractors.

* The C.C.S. Formula.

By E. R. Behne.

Introduction.

Whilst on the surface it would appear that the transaction whereby the cane farmer sells his cane to the miller represents simply a case of a manufacturer acquiring his raw material from a producer, it is, in fact, an entirely different matter. Indeed, the most satisfactory way of viewing the position is to consider the two parties—the grower and the miller—as partners in the one enterprise. The reasons for this are—

(*a*) The grower is compelled to supply the one particular mill.
(*b*) The miller is compelled to accept the cane from the grower (provided its quality is above a certain low standard).
(*c*) The sugar manufactured is acquired by the Government.
(*d*) The price of sugar is determined by the Government.
(*e*) The price of cane is fixed in relation to the price of sugar.

Under these conditions there is complete absence of competition, and as the money received for the sale of sugar is shared between the two parties in a manner determined by law, it is obvious why the relationship between the miller and grower has been referred to as a partnership. This is an aspect not always fully appreciated.

In determining the distribution of money between the two parties several methods may be used—and, in fact, are used—in the different sugar countries throughout the world. These vary from very simple methods such as the flat rate method whereby weight of cane only is considered, to complex systems involving evaluation of quality by chemical test. The system in use in Queensland is by far the most highly developed in the world, and by comparison those of other countries are rather crude.

The value received by a Queensland farmer for his crop depends on the weight and the quality of the cane. The weight is, of course, determined directly by means of a weighbridge and the quality by analysis in the mill laboratory of samples of juice taken from the mill. It is from these analyses that is calculated a value known commonly as C.C.S. These letters are the initials of "Commercial Cane Sugar." It is in connection with this C.C.S. as a measure of quality that we are primarily concerned in this talk.

Quality of Cane.

When referred to sugar cane, quality has really two meanings—(*a*) sugar content and (*b*) condition—and both these meanings are taken into consideration in determining the value of the material. We will now examine these in some detail.

* A lecture delivered at the Third Sugar Agriculture, and Tractor School at Gatton College in January, 1948.

Definition and Meaning of C.C.S.

C.C.S. or Commercial Cane Sugar may be defined as "such portion of sucrose or cane sugar contained in a certain quantity of cane as would be obtained in the form of pure white sugar of 100 net titre if milling and refining recovery could be raised to a prescribed imaginary standard of very high efficiency."

C.C.S. thus represents a "theoretical yield," and under the name of P.O.C.S. (Pure Obtainable Cane Sugar) was originally designed for, and applied to, factory control. Its use in connection with the payment of cane did not commence till some thirty years after the formula was first proposed.

The P.O.C.S. formula was devised by Dr. Kottmann, of the C.S.R. Co., in 1888. Prior to that date it apparently was the custom of the C.S.R. Co. to evaluate mill performance simply on the basis of the amount of sugar recovered in relation to that introduced in the cane, without any consideration being given to the presence of other constituents of the cane which clearly influenced the milling work.

Sugar exists in the cane dissolved in water. Also dissolved in this water are other soluble substances, and the whole liquid content of the cane is, of course, referred to as the juice. Since the important constituent is sugar, the other substances are impurities and are referred to by that name. Juice thus consists of sugar, impurities, and water. The total dissolved material—i.e., the sugar plus the impurities—is known as the "brix" of the juice, and the more nearly pure the juice the closer will the sugar and brix values be. In practice it is customary to refer to the "purity" of the juice, which is $\frac{\text{sugar}}{\text{brix}} \times 100$. A purity of 90 simply means that 90 per cent. of the dissolved material in the juice is pure sugar. The recovery of sugar is merely the separation of the sugar from the impurities. These impurities ultimately appear in the form of final molasses, and in this regard they have a two-fold effect. Firstly, the more of these impurities—i.e., the lower the purity of the juice—the greater is the relative quantity of molasses; and, secondly, their presence in solution prevents the sugar from being completely crystallized and recovered. Thus, of two juices with the same sugar content but of differing purity, the one with the lower purity will yield the less sugar.

Realising the detrimental effect of the impurities on sugar recovery, Dr. Kottmann devised his formula after examining the results of the C.S.R. Co.'s factories over a long period. Expressed in its simplest form, this formula states that the sugar recoverable (P.O.C.S.) from a given quantity of cane is less than the sugar present by an amount equal to one-half the impurities in the juice in the cane, i.e.—

$$\text{P.O.C.S.} = \text{sugar in cane} - \frac{\text{dissolved impurities in cane.}}{2}$$

In this way, Dr. Kottmann attempted to provide a standard basis of comparison which took into consideration the quality of the cane as well as its sugar content.

In 1915, with the inauguration of the Sugar Cane Prices Board, some measure of cane quality was required for payment purposes. Kottmann's P.O.C.S. formula appeared the most satisfactory and was adopted, its name, however, being changed to C.C.S., and this is the formula in use at the present day. For the rest of this talk we shall refer only to C.C.S. and not P.O.C.S.

The Determination of C.C.S.

As already pointed out the C.C.S. in cane is the sugar in cane less half the dissolved impurities in the cane. Unfortunately, in practice it is not feasible to analyse the cane itself, so the obvious expedient is adopted of analysing the expressed juice and then converting the values for the juice back to the whole cane. The conversion factors for this purpose were worked out by Kottmann also. These are—

$$\text{Brix in cane} = \text{brix in first expressed juice}\left(1-\frac{3+\text{fibre in cane}}{100}\right)$$

$$\text{Sugar in cane} = \text{sugar in first expressed juice}\left(1-\frac{5+\text{fibre in cane}}{100}\right)$$

The impurities in the cane are obviously the difference between these two values.

Let us now follow the operations that take place at the mill when a farmer's cane comes into the factory. In accordance with the Cane Prices Regulations, the clerk at the weighbridge tags the appropriate trucks for sampling. In the case of normally-loaded tramway trucks, every fifth or sixth truck is so marked. When the marked truck is tipped into the carrier, the position of the cane on the carrier is noted and so its passage up the carrier accurately followed. When this cane is actually passing through the first mill, the sample boy takes a continuous sample of the juice expressed by the top and front rollers—i.e., "the first expressed juice." This sample is strained to remove pieces of cane and then taken to the laboratory for analysis.

(In some countries the juice sample is obtained by crushing in a small laboratory mill a couple of sticks taken from the truck—a most inaccurate method when compared with the Queensland method.)

In the laboratory a small portion of the sample is treated with a clarifying agent and filtered. The juice is thus rendered perfectly clear, and the quantity of sugar is then determined in an instrument known as a polariscope. This determination gives the sugar in the juice (or the pol as the chemist calls it).

(Again in some countries this is all that is done—the pol value being multiplied by a factor called the Java ratio, to give the sugar or pol in cane, and payments are then based on this figure. As already pointed out, this value alone does not give the true quality of the cane.)

The quantity of brix in the juice is then determined by allowing the juice to stand for a period in a tall cylinder so that suspended matter settles out, and then obtaining the reading given by an instrument which is floated in the juice. This instrument is called a "brix spindle." The greater the brix of the juice the higher will the spindle float, and so the greater will be the reading.

It will have been noted that the conversion factors devised by Kottmann for relating the juice composition to that of the cane involve the use of the fibre of the cane. Hence before the C.C.S. value may be calculated from the analyses of the sample of juice taken by the juice boy, the appropriate fibre value must be available. The determination of the fibre content of the cane is a long and tedious job, and could not be determined for each juice sample taken. Several sticks of cane, however, are taken from each sample truck and at specified intervals, the sticks so taken are segregated into groups according to variety, whether plant, ratoon or standover, and also (if necessary) green or burnt. Each group of sticks is then sub-sampled and analysed for fibre in accordance with the method prescribed in the Cane Prices Regulations. Thus, a

fibre value is obtained for each variety and class of cane, and the appropriate one for the particular juice sample is used to calculate the C.C.S.

The evaluation of cane in Queensland is thus a very comprehensive procedure—far more so than that adopted in any other country.

Furthermore, the entire procedure, including the weighing of the cane, is under the supervision of the cane tester. The cane tester is a Government officer stationed at the mill to act as an impartial referee, and all operations associated with the evaluation of the cane must be to his satisfaction.

In an average Queensland mill some 20,000 farmers' samples are treated in a season, and as will be gathered from the foregoing description this represents a tremendous amount of work on the part of the mill chemical staff.

Coefficient of Work.

A term involving the use of C.C.S. and employed in the Queensland industry to assess the performance of the factory is known as the coefficient of work. The exact meaning of this term is not always fully understood, and frequently one finds a mill being viewed with suspicion because its coefficient of work exceeds the hundred mark. This, of course, is based on the erroneous assumption that the term is a percentage one, and that therefore the 100 is the absolute upper limit. I, therefore, wish to discuss this term in order that its significance may be fully appreciated.

The coefficient of work is defined as the tons of 94 net titre sugar produced per 100 tons of C.C.S. introduced into the factory in the cane. Now it will be recalled that C.C.S. represents a theoretical yield of *pure* sugar obtainable at a certain standard of performance, whereas 94 net titre sugar is *not* pure sugar.

Suppose for a moment a mill attained the standard of performance specified by the C.C.S. formula, then 100 tons of C.C.S. introduced would yield 100 tons of *pure* sugar. Pure sugar has a net titre of 100, hence the corresponding quantity of 94 net titre sugar is $100 \times \frac{100}{94} = 106{\cdot}4$—i.e., in this instance the true coefficient of work is 106·4. Thus the limit in the coefficient of work set by the C.C.S. formula is 106·4, and even this would be surpassed should a mill attain a standard of performance better than that prescribed by the formula.

The absolute limit would occur if a mill recovered in the form of pure sugar all the sugar in cane. Let us illustrate this by an example:

Suppose the total sugar in 100 tons of cane was 16 tons.

Suppose the corresponding C.C.S. in cane were 15 tons, and the sugar recovered (pure sugar) 16 tons.

The corresponding tonnage of 94 n.t. sugar is $\frac{16 \times 100}{94} = 17$ tons (approx.). The coefficient of work would then be $\frac{17 \times 110}{15} = 113$ (approx.).

It is impossible, of course, for a mill to achieve such a standard of performance, but the example has been included to illustrate the point that the coefficient of work can considerably exceed the 100 mark quite legitimately.

The 1948 Tractor School.

By Hector Reghenzani and other representatives of the students.

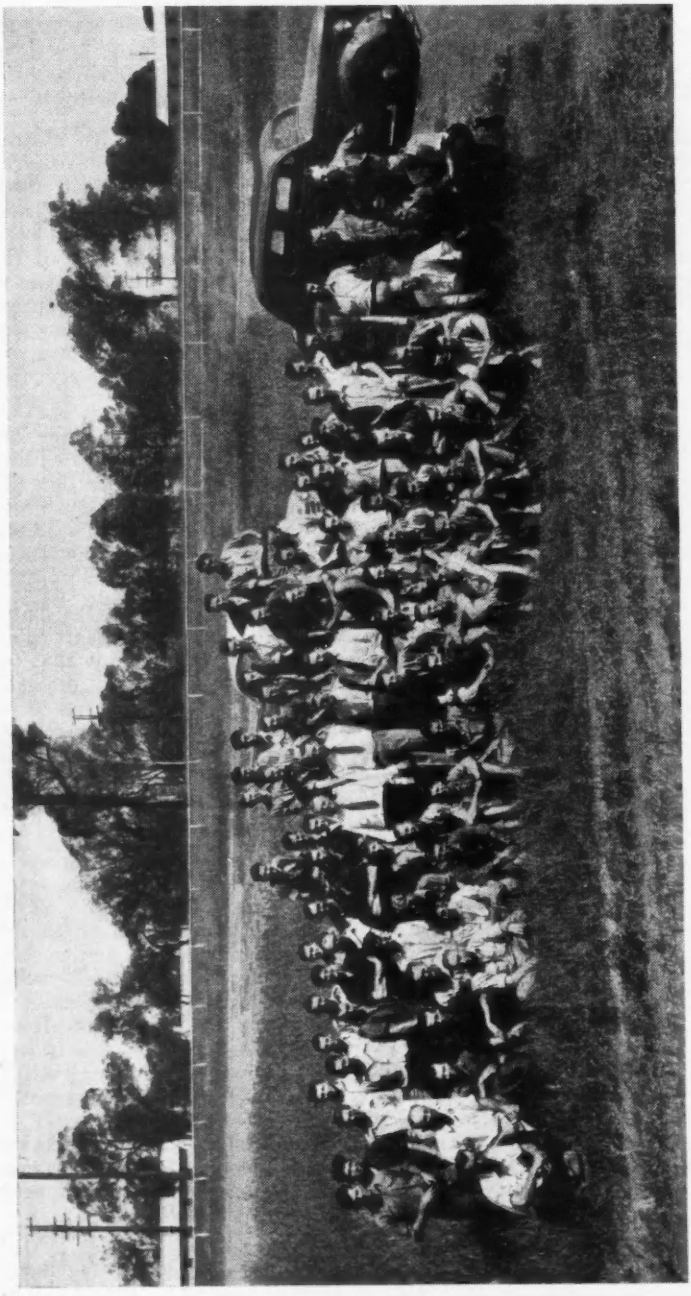
AFTER the cinders and smoke of the Queensland Railways had cleared away from the siding at Lawes we could observe that two large trucks were drawn up ready to transport us to the Queensland Agricultural High School and College. These were a cause of some disappointment, since all the way down from the North we had been warned that we would be met by two horse-drays, reminiscent of the pioneers. Still, we were soon to realise, it was not necessary to have old-fashioned transport to get a thrill. Having received good training in railway refreshment-room rushes, the law of "every man for himself" soon asserted itself, and the stampede for transport was on. Strangely enough there were no trampled forms left lying about after the "mob" had settled.

Our manner must have been contagious, for no sooner had the last port been thrown into the tail man's lap than the Fords roared to life, screamed through gears, jumped the culvert, flew across the cattle grid, screached around a few corners, and stopped in front of a cluster of buildings. A mile had been covered. On our arrival a member of the Bureau was heard to mention that the heaps in the back of the trucks reminded him of a pushrake-harvested, Hawaiian cane crop.

Though our senses were somewhat dulled by the rush of the drive, we shortly realised that body and soul were still together, and extricated ourselves from the mass in the trucks. One can well imagine that we had not seen very much of what later proved to be a very pleasant driveway of ornamental trees and palms. The terminus proved to be a driveway surrounding a large, circular lawn, containing two stately palms. On all sdies of us were well-tended gardens, trees, and shrubs, whilst the general atmosphere contained a promise of rest and contentment. Our first impressions of Gatton College were of admiration for its picturesque beauty and its dignified atmosphere.

The boys had by this time remembered that they were representativs of the sugar industry with some dignity to uphold, and were acting accordingly. In an efficient manner, Mr. Grogan, the officer on duty, allocated us our rooms in the four dormitories placed at our disposal. He must have been impressed with our quiet, gentlemanly manner. Little did he know that in a few short days the cloak would be thrown off and the peaceful atmosphere of Gatton College shattered by the "my tractor is better than yours" boys of the cane fields. However, the lads were a fine bunch, even if we did have our "Bluey and Curley," "Ben Bowyang," "Professors," and even a few "Supermen" thrown in here and there. The latter, of course, gave us a few hectic moments. The professors grouped in a room (owner not present) on the last night and tried to simulate the effects of a bomb explosion in an enclosed space. From accounts by the room's owner it was a convincing demonstration, though I know at least one person who thought it was not the place for a practical demonstration of theories.

And so it was that the third Tractor School arrived and settled in at Gatton College. We had just taken our shoes off and lay down to rest our weary bones, when the unearthly scream of an air-raid siren



[Photo. Agriculture and Stock.

Fig. 65.—The Third Tractor School gathered outside Riddell House.

stood our hair on end and lifted us 6 inches off the bed, just to tell us that "chow" was on. The social event of Sunday tea assisted the settling-down process, and helped break the ice, whilst old acquaintances were renewed and new friendships developed.

Shortly after tea Mr. N. W. Briton, the Principal of the College, introduced himself and several others, who would be our lecturers for the coming week. After a very cordial welcome by Mr. Briton, we returned to our respective dormitories for a much-needed rest, as many had been travelling for the last three days, whilst others—well, suffice it to say—needed a rest also. The suggestion had been made for each dormitory to elect a representative to look after the dormitory interests, and this was duly done.

Monday morning, 8.20 a.m., saw the commencement of a very comprehensive course of lectures. The first two lectures were absorbed with keen interest, but by the end of the last lecture (it happened to be one on plant nurtition) constant mental pictures of food and personal nutrition made concentration difficult. The boys did miss the regular smoke and "smoko," and it is suggested that to overcome this, each lecture should start sooner after breakfast and there should be four lectures of 40 minutes each, with breaks between to allow smoking and the buying of some eats at the tuck-shop. Actually, it took the first few days to become used to the climate and reduced rations (cane farmers being such voracious animals), and for a start we were left with unappeased appetites and correspondingly reduced activity, but by Thursday night acclimisation had been completed, and belts started to be let out a notch or two. One fellow was heard to say he was sorry he had cut off the excess length of belt. Still, in his case, a belt was not necessary, as his corpulence was doing the job. The holiday was taking effect.

At 12.45 p.m. it was time to direct our footsteps towards the tractors at Riddell House and to commence what should have been the most interesting part of the school. Unfortunately, there was disappointment for several, as no crawler or diesel types were available. However, the few mechanics available showed their mettle by making the best of the shortage. It was due to the diligent and continued efforts of this admirable few that the success of the practical side of the school was made possible, and I take this opportunity of thanking the Massey Harris, Case, International Harvester, and Fordson companies for sending us such capable and competent mechanics and instructors to satisfy our thirst for more and more tractor knowledge. Although we no doubt irked them with out continual bombardment of questions, they maintained their cheerfulness and pleasant manner throughout the course of the school. An important feature introduced by the Fordson and Massey Harris people, particularly the latter, was the lecturing on various aspects of tractor operation. These talks on ignition, carburettion, effects of heat on valves, combustion chambers, oil filters, air cleaners, tricks in bearing and piston ring fitting, ill effects of bent connecting rods, vacuum gauges, carburettor-testing equipment, and a host of other items were illustrated by company charts and diagrams, and provided a wealth of information upon which we can draw to keep our tractors at the peak of efficiency. In particular, no amount of praise would be too much for the lectures by the Massey Harris foreman mechanic with his easily understood explanations. Apart from these

Fig. 65.—The Third Tractor School gathered outside Riddell House.

chart lectures, we had practical work in the complete overhaul of engines, fitting new timing gears and clutch plates, various adjustments, tyre changes, and transmission inspection. The secrets of timing magnetos and camshafts, &c., received close attention, and I am sure "Pop" will not be stuck with a broken-down magneto, or badly timed motor in future.

[*Photo. Agriculture and Stock.*

Fig. 66.—A group of students interested in a tractor lecture.

Seeing the various makes of tractors stripped simultaneously, we were able to compare relative components, and to judge for ourselves the advantages of each make. Instruction such as this, where we did the actual work ourselves, is the ideal method of learning. By these visual comparisons and talks with the other boys, we are in a position to judge the truth of claims made in advertising the superior features of one or other make.

At 7 o'clock each evening we had a half-hour question period, which proved most enjoyable. It was our opportunity to nail the day's lecturers on questions of personal interest and settle once and for all arguments which sometimes split the farming community into two camps, e.g., Does cultivation during a dry period help or hinder plant growth? The question periods were followed by educational films which were appropriate to the studies of the school. They dealt in a graphic manner with the possibilities of machinery correctly applied on a large scale to agricultural practice. Important also were the films dealing with the care of this machinery by correct lubrication when working and adequate housing when at rest. We wish to extend our heartfelt thanks to the Caltex, Vacuum, and Shell Oil Companies, the International Harvester Company, and Waugh and Josephson for their co-operation in making these films and technical representatives available.

Special mention must also be made of the various prominent visiting lecturers, who gave their services to further our knowledge in carburettion and ignition in relation to fuel performance (Mr. Hodgens), soil erosion (Mr. Ladewig), rubber tyre equipment (Mr. Blue), pumps

and pumping (Mr. Gallagher), and farm book-keeping (Mr. Bruce Henderson). The last-named handled a dull subject with a good deal of humour, and gave us one of the most stimulating lectures of the school. Our eyes were opened to the fact that taxation can be reduced to a great extent by applying for rebatable items which are not commonly realised to be such.

All members of the school appreciate very sincerely the efforts made by Mr. Briton and staff in the provision of social amenities. No request by us was too much trouble for them. College trucks were provided for a delightful trip to Toowoomba on Sunday, 25th January. All points of interest were visited, and I wish to thank our two driver guides for sparing no effort to provide what proved to be one of the most enjoyable days of our lives. Many of us were visiting Toowoomba for the first time, but all left convinced that here was indeed, the garden city of Queensland. The magnificent view from the "look out" was truly awe inspiring, and the gardens were in full flower, providing a beautiful sight, as well as subjects for numerous snapshots. Numerous other places were visited on that day and we retain most vivid recollections of the trip to the Colby Dam. This structure provides water for Toowoomba, and fortunately was finished before the 40-hour week. The acre-inches backed up in this reservoir must tally to an enormous figure, and should certainly be more than enough to see Toowoomba through any possible drought or succession of droughts. In was indeed a mighty project.

Special mention is also necessary for the keen personal interest Mr. Briton and Mr. May have taken in the preparation and delivery of a number of interesting and instructive lectures on care and management of farm horses (Mr. Briton) and tractors (Mr. May).

Up to this point, the Bureau, which organised the school, has received no praise. This is not due to any failing on the Bureau's part in running the school. On the contrary, the entire school is of one voice in thanking the Bureau for the tremendous amount of work undertaken in organising and directing this most successful and happy function. No small portion of the work consisted of the preparing and printing of the lectures. These lectures were delivered in an interesting manner, plus a spirit of camaraderie, by all members, whilst the notes were a popular new feature which should be a "must" in future schools. Not only will they provide a small library of information for reference in future years, but will be studied and appreciated by a great number of those who did not have the good fortune to attend the school. When the question arises as to whether another tractor school should be held next year, we all speak as one, when we advise most emphatically, by all possible means. Even though there have been some shortages on the practical side, the tremendous amount of information derived has more than made the school definitely worthwhile, and will help us a great deal in becoming well prepared, mechanically minded, scientific farmers. This school, plus the field days at the various Experiment Stations, has given a good understanding of the great amount of work done and being done by the Bureau. We have been shown just how slow and tedious most experimental work is and we have been made more conversant with Bureau practices and controls.

Thursday night saw the farewell party, which proved a most successful event. Speeches were made by members of the various groups and the old favourite sung in honour of the College, Company Mechanics, Domestic Staff, and Bureau. As a token of the school's appreciation, all members, without exception, contributed towards a presentation, which was made to Mr. Briton. It will be placed in the fund being collected for the building of a swimming pool on College Hill. In replying, Mr. Briton delivered one of those fluent and delightful addresses for which he is noted.

We trust that this brief note from the students of the school will convey to all concerned some measure of the feeling of satisfaction and contentment at the conduct of the school and the amount of information which was imparted to us. There is no doubt at all in our minds that it was a splendid success.

A. H. Tucker, Government Printer, Brisbane.